

# DEBT SHIFTING RESTRICTIONS AND REALLOCATION OF DEBT

Katarzyna Habu\* Yaxuan Qi\*\* Jing Xing\*\*\*

This Version: 05.11.2018

---

**Abstract:** This paper analyses the effects of tax incentives on the location of debt for multinational firms. Using a difference-in-differences approach, we provide causal evidence on the effect of the UK worldwide debt cap reform in 2010. The reform restricted tax deductions available to the UK subsidiaries of multinational companies. We find that firms that were affected by the debt cap reduced the tested debt ratios. Multinationals headquartered in the UK have reduced the level of the UK net debt without changing their worldwide debt holdings. Foreign headquartered multinationals instead have increased their worldwide debt holdings without changing the level of the UK net debt. We find an increase in leverage ratios in non-UK subsidiaries of all affected multinationals after the reform. This increase is more pronounced in affiliates located in higher tax countries. We also find that the fraction of affected multinational affiliates located in high tax countries increases after the reform, while the fraction located in lower tax countries declines. This provides evidence for debt shifting.

*JEL: H25, H26*

*Keywords: Debt Shifting, Tax Avoidance, Multinational Companies, Debt Allocation*

---

---

\* NBER and Oxford University Centre for Business Taxation, 1050 Massachusetts Ave, 02138, Cambridge, United States; katarzyna.anna.bilicka@gmail.com.

\*\*City University of Hong Kong, Department of Economics and Finance, Hong Kong, yaxuanqi@cityu.edu.hk

\*\*\* Antai College of Economics and Management, Shanghai Jiao Tong University, 1954 Huashan Road, Shanghai 200030, China, jing.xing@sjtu.edu.cn

## 1. Introduction

The issues of tax avoidance and profit shifting by multinationals have been prominent in political discussion in the recent years. Multinationals can utilize various tax planning strategies to minimize their overall tax bill. Internal allocation of debt is one of the widely used instruments. Many countries have attempted to curb the extent of debt shifting of multinationals by implementing policies such as the thin-capitalization rules. The thin-capitalization rules usually consider each subsidiary of the multinational as a separate entity, while in reality the financing policy of the multinationals is likely to be highly centralized. More recently, the OECD has proposed a “worldwide” approach that aims to limit interest deduction and the UK has led the field by introducing the "worldwide debt cap" reform in 2010. These types of approaches consider the allocation of debt across multinational affiliates by comparing the amount of debt located in each country to the total amount of debt held by the multinational firm.

This paper analyses how multinational firms respond to restrictions on where to locate their debt holdings. We consider the effect of the 2010 UK “worldwide debt cap” on multinationals’ financing policies and organizational structures. We find that affected multinationals have reduced the testable ratios of debt in the UK. This does not necessarily mean that the worldwide debt of the affected multinational firms was reduced. Instead, we provide novel evidence that the affected multinationals have increased the leverage in their non-UK subsidiaries, especially those located in high tax countries. We strengthen the evidence for debt shifting, by showing that those affected multinational firms also have increased the proportion of high tax affiliates and reduced the proportion of the low tax affiliates as a result of the reform. Findings from our study contribute to the on-going discussion about alternative approaches to tackle tax avoidance by multinationals.

The UK “worldwide debt cap” was implemented in 2010 to complement the existing thin-capitalization rules and was applicable for periods beginning on or after 1 January 2010 and up until April 2017, when a new debt cap rule replaced the worldwide debt cap. To apply this rule, the net debt of all UK relevant subsidiaries of a multinational company is first added together, and a gateway test based on the ratio of total UK net debt to the multinational’s worldwide gross debt is conducted for each multinational group that has operations in the UK. If the UK net debt exceeds 75% of the group’s worldwide gross debt, interest deduction on the excess is

disallowed. Hence, if internal debt is located in the UK mainly for the purpose of reducing tax payment, we expect to observe changes in the financing policy and organizational structures of multinationals that were affected by the cap.

Previous empirical studies show that debt holdings of multinationals' subsidiaries are highly sensitive to the corporate tax rates in home and host countries (Desai et al., 2004; Huizinga and Leaven, 2008). These studies rely on cross-country differences in tax rates to identify debt shifting activities of MNCs. By demonstrating that debt ratio of subsidiaries in high tax rate regime is higher than that in low tax regime, prior research suggests that debt shifting is an important instrument for tax planning by multinational firms. However, debt financing is often affected by multiple factors such as country level financing environment and investment opportunities, which may not be related to tax planning. By using UK worldwide debt cap reform as a quasi-natural experiment, we can analyze directly the causal effects of changes in interest deductibility on MNC debt allocation in order to offset the impact of tax reform.

During 1996-2005, all OECD countries with thin-capitalization rules or similar restrictions employed the so-called "fixed ratio approach" (OECD, 1987) to tackle the debt shifting problem. The thin capitalization rules usually set the ceiling for companies' debt-equity ratio while treating each subsidiary of the multinational as a separate entity. Despite some evidence that thin capitalization rules reduce multinational companies' incentives to use internal debt for tax planning purposes (Buetnner et al., 2012; Blouin et al., 2014), the limitation of the fixed ratio thin capitalization rule has also become apparent over the years. For example, multinationals could inject equity to subsidiaries with a high debt-equity ratio to avoid exceeding the fixed ratio. More importantly, the thin-capitalization rules do not link the subsidiary's financing policies to the multinational group's overall financing positions. In contrast, the "worldwide approach" use the group company's external borrowing as a benchmark to gauge whether the subsidiary has "too much" debt, possibly for tax avoidance purposes. This is the first paper to consider the casual effects of debt restrictions on the financing policy of multinational companies based on the alternative "worldwide approach".

Using the Difference-in-differences approach, we first examine the effects of the 2010 worldwide debt cap reform on the level of UK net debt of multinationals that exceeded the cap, relative to those with a gateway ratio below the 75% threshold. We also compare affected and unaffected multinationals in terms of their consolidated gross debt level. Second, we

investigate the effects of the reform on potential debt shifting across non-UK subsidiaries of the affected multinational companies Third, we examine whether the UK cap led to changes in the organizational structure of affected multinationals by tracing firms' ownership structures over time.

First, we find that the ratio of UK net debt to worldwide debt of the affected companies has declined following the reform introduction. This suggests that the worldwide approach is effective in curbing excess borrowing for pure tax planning purposes. We uncover an interesting heterogeneity underlying this baseline result. We compare multinational companies headquartered in the UK and those with foreign parents and find that the debt adjustment patterns differ between the two types of companies. In particular, affected UK-headquartered multinationals lowered the gateway test ratio by reducing their net UK debt holdings as a response to the reform, while keeping the level of worldwide gross debt unchanged. In contrast, affected MNC headquartered outside of the UK lowered the gateway ratio by increasing the level of worldwide debt holdings while keeping the level of UK net debt unchanged. This suggests that the UK worldwide debt cap is perhaps more effective in restricting excess internal borrowing of the UK-headquartered multinationals. This evidence also echoes the potential concern on the tax reform that it may encourage multinationals raise more external debt.<sup>1</sup>

Second, we analyse whether the “worldwide debt cap” rule lead MNC to shift debt from UK to non-UK subsidiaries. Specifically, we study the debt ratio change of non-UK subsidiaries that belong to an affected MNC, relative to those that belong to unaffected MNCs. This is an important analysis for our project, as it sheds light on whether the worldwide approach to tackle debt shifting implemented by one country could have spill over effect on other countries. Using difference-in-difference approach, we find strong evidence that debt ratio of non-UK subsidiaries of the affected MNCs increase significantly following the UK tax reform relative to the unaffected MNCs. More importantly, we find that affected MNCs are more likely to shift internal debt to countries which have statutory tax rate higher than that in the UK. This pattern is consistent with debt shifting strategies.

---

<sup>1</sup> In 2017 UK has introduced new rules on interest deductibility, where the worldwide debt denominator was replaced by EBITDA. This change likely reflects the concern that multinationals may be using worldwide gross debt manipulations to achieve the desired gateway test ratios. We show that this concern was valid.

Third, we provide novel evidence on the effect of anti-tax avoidance policies on organizational structures of MNCs. We examine whether the UK worldwide debt cap had an impact on organizational structures of multinational companies. Our data allows us to track changes in organizational structures for the same MNC over time. More specifically, we examine whether the percentage of subsidiaries located in high-tax-rate and low-tax-rate countries changed, if the MNC failed the gateway test. Our findings indicate that multinationals adjust the location of their affiliates to offset the negative impact of anti-tax avoidance rules.

Overall, our study provides new insight into the effectiveness of the worldwide approach to tackle the debt shifting and tax avoidance by multinationals. In December 2017, the US has passed the Tax Cuts & Jobs Act in which proposals were outlined to put limit on net interest expense deductions of multinational companies in the US.<sup>2</sup> The proposed US reform is similar to the UK one. There also exists an active debate on the pros and cons of the worldwide approach. Therefore, our paper contributes to the understanding the effects of worldwide approach and the evaluation of potential effects of the US proposals.

## 2. Data and sample construction

To examine the direct effects of the worldwide debt cap reform on multinationals debt holdings, we collect both multinational group level (i.e. parent level) and subsidiary level data. Further, we identify the ownership relation between group and subsidiaries. We use several databases to construct our sample.

Since the tax reform occurred in 2010, we use the 2010 Bureau van Dijk (BvD) Osiris to extract a sample of parent firms which own at least one relevant subsidiary located in the UK. The worldwide debt cap rule only applies to large “*worldwide group*”. We therefore restrict our sample to global ultimate parent firms. This means that we exclude firms which are owned 50% or more by a single shareholder. We exclude financial firms from our sample because the worldwide debt cap does not apply to them. Osiris provides the name and the location of multinationals’ subsidiaries, which allows us to identify multinationals with at least one UK subsidiary. It worth noting that the rule defines a *relevant subsidiary* as 75% owned subsidiary

---

<sup>2</sup> The proposal put a limit on net interest expense deduction of the U.S. borrower at 110% of the U.S. borrower’s share of the group’s overall earnings. <https://www.clearygottlieb.com/~media/files/updated-tax-reform-12-7-17/3423467v9tcja-summary--nonus-debt-capital-markets-dec-7.pdf>

and the net UK debt is calculated using only these relevant subsidiaries. We therefore require a group to own at least one 75% UK subsidiary in order to be included in our sample. Using the historical CDs from 2005-2014, we extract subsidiaries affiliated with the group sample with at least 50% controlling shares. Importantly, we observe the ownership structure of multinational groups annually, which enables us to trace changes in ownership and organizational structures over time.

Next, we obtain consolidated financial data from Osiris for the group company, which allows us to construct the multinational group's consolidated gross debt. We obtain unconsolidated financial data for multinationals' UK subsidiaries from FAME, which allows us to construct these subsidiaries' UK net debt. Furthermore, to analyze debt allocation between UK and non-UK subsidiaries, we use Orbis database to obtain financial data for the multinational groups' non-UK subsidiaries. We find 1,268 multinational groups, which had at least one relevant UK subsidiary in 2010. In our benchmark sample, we obtain financial and ownership information for these multinational groups during the period 2008 – 2016.<sup>3</sup>

We follow HMRC's definition to calculate the UK net debt and worldwide gross debt using Osiris and FAME. We calculate the net UK debt and the worldwide gross debt for multinational groups in our sample by aggregating the total UK net debt of all *relevant* subsidiaries. To be considered as a *relevant* subsidiary by the HMRC, at least 75% of the UK subsidiary needs to be owned by the multinational group. Once we construct the annual UK net debt and worldwide gross debt for each multinational group, we use the HMRC guideline to construct the gateway test ratio for multinational  $i$  in year  $t$ ,  $Gateway_{i,t}$ , as  $[UK\ net\ debt_{i,t-1} + UK\ net\ debt_{i,t}] / [Gross\ debt_{i,t-1} + Gross\ debt_{i,t}]$ . A multinational failed the gateway test, if its gateway ratio exceeded 75% in 2010. We find that 174 multinational groups in our sample failed the gateway test. 148 of these failed multinationals are headquartered in the UK and the rest are headquartered elsewhere.

To account for the differing characteristics of various multinational groups, we perform propensity score matching. We match companies using the one-to-one matching algorithm without replacement by industries, the location of the group parent, group size and profitability

---

<sup>3</sup> Note that the organizational structure information that we have ends in 2014.

in 2010. After matching, we obtain 110 groups that failed the gateway test in 2010 and 110 groups that did not fail the gateway test.<sup>4</sup>

### 3. Empirical strategy

We use Difference-in-Differences methodology to investigate the responses of multinationals to the 2010 UK worldwide debt cap. Multinationals that failed the gateway test in 2010 are in our treated group, while those that passed the test are in the control group. We conduct three sets of experiments.

#### 3.1 Effect on group gross debt and UK net debt

We first estimate the effect of the cap on multinationals' gateway ratio based on the following specification:

$$Gateway\ test_{i,t} = \alpha_1 + \beta_1 \times Failed_i \times Post_t + \gamma_1 Failed_i + \delta_1 \times X'_{it} + \vartheta_t + \varphi_i + \varepsilon_{i,t} \quad (1)$$

where  $Gateway\ test_{i,t}$  is the ratio of total UK net debt to the consolidated group gross debt (i.e. the gateway test ratio);  $Failed_{i,t}$  is a dummy variable that equals 1 if multinational  $i$  failed the gateway test in 2010, and 0 otherwise;  $Post_t$  is a dummy variable that equals 1 from 2010 onwards;  $X'_{it}$  is a set of group-level control variables, including group size and profitability;  $\vartheta_t$  is the time fixed effect,  $\varphi_i$  is the parent-specific fixed effect, and  $\varepsilon_{i,t}$  is the error term. The coefficient of interest is  $\beta_1$ , which captures the treatment effect of the worldwide cap rule on the multinational companies' UK net debt ratio. If high levels of UK net debt observed among failed multinationals is mainly used to reduce UK taxable income, we should observe a decline in the gateway test ratio after the implementation of the worldwide debt cap. In this case, we expect the coefficient  $\beta_1$  to be negative.

There are two ways to reduce the gateway test ratio either by reducing the numerator (net UK debt) or by increasing the denominator (worldwide gross debt). We therefore study the net UK debt and worldwide gross debt respectively in equations (2) and (3). First, a MNC can reduce

---

<sup>4</sup> We do not find a match for every affected multinational in our sample. We have missing profitability and group size for some affected firms. Also, matching simply did not find comparable control companies.

the gateway test ratio by reducing the level of UK net debt while keeping the worldwide gross debt unchanged. In this case, we expect the coefficient  $\beta_2$  to be negative. As reducing internal debt holdings in specific host countries is the goal of the “worldwide approach”, it is of policy importance to investigate whether the debt cap achieved this goal. More specifically, we estimate Equation (2):

$$UK\ net\ debt_{i,t} = \alpha_2 + \beta_2 \times Failed_i \times Post_t + \gamma_2 Failed_i + \delta_2 \times X'_{it} + \vartheta_t + \varphi_i + \varepsilon_{i,t} \quad (2)$$

One criticism of the “worldwide approach” to tackle multinationals’ debt shifting behaviour is that it may lead to higher level of external borrowing. Indeed, the second way for the multinationals to pass the gateway test is to increase external borrowing while keeping the UK net debt unchanged. To investigate this possibility, we replace *UK net debt*<sub>*i,t*</sub> with the group consolidated gross debt, *Gross debt*<sub>*i,t*</sub>, and estimate Equation (3):

$$Gross\ debt_{i,t} = \alpha_3 + \beta_3 \times Failed_i \times Post_t + \gamma_3 Failed_i + \delta_3 \times X'_{it} + \vartheta_t + \varphi_i + \varepsilon_{i,t} \quad (3)$$

### 3.2 Effect on debt allocation within groups

To fully understand the impact of the UK worldwide debt cap, we also need to investigate possible reallocation of debt between UK and non-UK subsidiaries for the multinationals that failed the gateway ratio test. It is possible that the multinational compensates the loss of interest deduction by shifting debt from its UK subsidiaries to non-UK ones, where no similar debt cap has been imposed. Hence, we examine the financial leverage of non-UK subsidiaries of failed multinationals, relative to those of unaffected multinationals. Based on the subsidiary level data from Orbis, we estimate Equation (4):

$$Leverage_{i,j,s,t} = \alpha + \beta \times Failed_i \times Post_t + \gamma Failed_i + \delta \times X'_{ijst} + \vartheta_t + \mu_i + \varphi_j + \varepsilon_{i,j,s,t} \quad (4)$$

where *Leverage*<sub>*i,j,s,t*</sub> is the net-of-cash leverage ratio of non-UK subsidiary *j* that belongs to multinational *i*, located in host country *s* in year *t*. The net-of-cash leverage ratio is defined as the ratio of [Total debt-Cash] to [Total assets-Cash]. If  $\beta$  is positive, this indicates that failed multinationals will shift debt to non-UK subsidiaries after the implementation of the UK

worldwide debt cap. Moreover, to understand whether debt shifting is tax sensitive, we interact  $\text{Failed}_i \times \text{Post}_t$  with the statutory corporate income tax rate that the non-UK subsidiary  $i$  faces in year  $t$  ( $\text{CIT}_{i,s,t}$ ). In order to use interest expense to reduce the tax liability, a group is more likely to shift debt to high-tax countries. If the debt reallocation is driven by tax purpose, we expect the interaction between  $\text{CIT}_{i,s,t}$  and  $\text{Failed}_i \times \text{Post}_t$  to be positive.

### 3.3 Effect on organisational structure of multinational groups

Another way that multinational group can adopt to reduce the effect of UK worldwide debt cap is to change the location of its subsidiaries. For example, they could sell the relevant subsidiaries in the UK to avoid the gateway test failure. Hence, we investigate the effects of the UK worldwide debt cap on organizational structures of failed multinationals. The Osiris sample of firms includes all 1,268 multinational groups which had at least one relevant UK subsidiary in 2010. Our data allows us to trace those subsidiaries ownership changes in the years 2005 – 2014. We calculate the time-varying number of subsidiaries located in high tax and low tax countries, as a ratio of the multinational's total number of subsidiaries.<sup>5</sup> We then estimate Equation (5):

$$\%Subsidiary_{j,s,t} = \alpha + \beta \times \text{Failed}_i \times \text{Post}_t + \gamma \text{Failed}_i + \delta \times X'_{jst} + \vartheta_t + \mu_i + \varphi_i + \varepsilon_{j,s,t} \quad (5)$$

where  $\%Subsidiary_{j,s,t}$  is the percentage of the number of subsidiaries belong to group  $j$  located in host country  $s$  in year  $t$ . In particular, we group countries  $s$  into high tax and low tax. Similar to debt reallocation, in order to use interest expense to reduce tax liability, a group may be more likely to increase the fraction of high tax country subsidiaries following the reform at the expense of low tax rate subsidiaries. Hence, we expect the coefficient  $\beta$  to be positive for high tax countries and negative for low tax countries.

## 4. Results

### 4.1 Graphical evidence

---

<sup>5</sup> Note that we do not analyze the absolute number of multinational subsidiaries. This is because there has been a change in the way that ORBIS records subsidiaries during our sample period.

In this section, we present graphical evidence on the effect of the UK worldwide debt cap. Figure 1a plots the average gateway test ratio for the treated and the control groups during the period 2009-2016.<sup>6</sup> The treated firms are those failed the gateway test in 2010 and they are firms affected by the worldwide cap rule. The control group is firms with the gateway test ratio below the threshold in 2010. Figure 1a indicates that our treated firms reduced the ratio of UK net debt to worldwide gross debt from 2011 onwards. In contrast, firms in the control group experienced an increase in the gateway ratio from 2011.<sup>7</sup> Note that for the multinationals that failed the gateway ratio test, the average gateway ratio does not immediately fall below the required 75%. This may be because it takes a few years to adjust the current debt policies.

Since the gateway ratio is defined as the UK net debt divided by worldwide gross debt, we plot the average of UK net debt and worldwide gross debt respectively in Figure 1b and 1c. First, note that the firms that failed the gateway test had on average higher UK net debt and lower worldwide debt than firms that did not fail the test. We find that the treated firms did not change their UK net debt much as shown in Figure 1b. Instead they increase the worldwide gross debt gradually after 2010 as shown in Figure 1c. In contrast, the control group clearly increase the level of their UK debt but maintain a stable worldwide gross debt. Overall, Figure 1 provides preliminary evidence that UK's worldwide debt cap rule has a real impact on debt holdings of multinationals.

In Figure 2, we distinguish between UK headquartered and non-UK headquartered multinational companies. We show that all UK headquartered multinationals maintain relatively stable worldwide gross debt. However, the treated group slightly reduce the UK net debt, probably in order to reduce the gateway ratio, while control group sharply increase UK net debt, probably to gain tax benefit of debt financing. In contrast, the non-UK headquartered treated multinationals sharply increase their worldwide gross debt, without really adjusting their UK net debt holdings. This leads to the decline in the gateway ratio from 2010 onward. By contrast, we didn't observe any pattern for control group. Overall, Figure 2 suggests UK-headquartered and non-UK headquartered multinationals respond to the worldwide debt cap in different ways. It seems that non-UK headquartered firms have more flexibility to adjust

---

<sup>6</sup> As we use the two-year average UK net debt and the two-year average gross debt to calculate the gateway test ratio, we cannot calculate the ratio for 2008 which is the first year in our sample.

<sup>7</sup> The gateway test ratios for firms that did not fail the gateway test are negative. This is because net debt can take negative values. Further, these results assume that the ownership structure of those multinationals did not change during the sample period. This is why we consider data until 2016 here.

worldwide debt in response to the reform. UK-headquartered firms seem to have more motivation to adjust UK debt.

#### **4.2 Impact of the worldwide debt cap on group-level debt holdings**

In Table 1, we report estimation results from Difference-in-differences analyses. In each specification we control for group size (the natural logarithm of group total assets) and group UK profitability (the ratio of total UK profits and loss before tax to UK total assets). We also include a common set of year dummies to control for the business cycle effects. In the odd numbered columns we control for industry-specific fixed effects, while in the even numbered columns we control for group fixed effects.

In Columns 1 and 2, we report the estimation results based on Equation (1) where the dependent variable is the gateway ratio. Column 1 shows that before the reform, treated multinationals had a significantly higher level of gateway ratio. However, treated firms experienced a significant reduction in the gateway ratio after the implementation of the worldwide debt cap. The estimated treatment effect is statistically significant at the 1 percent level. Controlling for group fixed effects in column 2, we continue to find that after the reform, treated multinationals significantly reduced their gateway test ratio relative to multinationals in the control group.

In Columns 3 and 4, we use the natural logarithm of UK net debt as the dependent variable and report the estimation results based on Equation 2. First, as with the gateway test ratio, treated multinationals had much higher UK net debt holdings than the control group before the reform. After the reform treated multinationals significantly reduced their UK net debt holdings relative to the control group. We obtain similar result in Column 4 with group-specific fixed effects. Since the dependant variable is in logarithms, we can interpret the estimated coefficients as percentage changes. Column 4 indicates that after the reform, the affected multinational groups lowered their holdings of net UK debt by 33% relative to the control group. This reduction is statistically significant at the 5 percent level.

In Columns 5 and 6, we report estimation results based on Equation 3 where the dependent variable is the natural logarithm of group consolidated gross debt. It is important to note that the treated multinational groups had on average lower gross debt than the control group before

the reform. This is consistent with the evidence from Figure 1c. However, we do not find a significant difference in gross debt between the treated and the control groups after the reform.

Figure 2 suggests that UK-headquartered and non-UK headquartered multinationals respond to the UK worldwide debt cap in different ways. To formally test this, we split the sample into two sub-samples: UK headquartered MNCs and non-UK headquartered MNCs. We report the results in Table 2. Throughout Table 2, we control for group-specific fixed effects, a common set of year dummies, group size and UK group profitability.

Results from Table 2 confirm the heterogeneities revealed in Figure 2. UK headquartered treated multinationals didn't significantly adjust the gateway ratio relative to control group (column 1), even though they experienced a decline in the tested ratio. The non-UK headquartered treated multinationals reduced the gateway ratio significantly relative to control group (column 2). The UK headquartered treated multinationals reduced their UK net debt by about 50% (column 3), without significant adjustment to their worldwide gross debt (column 5). On the other hand, non-UK headquartered multinationals did not significantly change their UK net debt (column 4) but increased their worldwide gross debt by almost 170% (column 6). In response to the worldwide debt cap rule, non-UK headquartered multinationals reduce the gateway ratio mainly through increasing worldwide gross debt. Those firms may find it easier to manipulate their gross debt outside of the UK as their headquarters are outside of the UK. UK-headquartered multinationals, since they are headquartered in the UK, they mainly respond to the reform by adjusting their UK net debt.

### **4.3 Debt reallocation across subsidiaries**

We showed that UK-headquartered multinationals that failed the gateway test in 2010 subsequently reduced their UK net debt holdings, while non-UK headquartered multinationals increased their worldwide gross debt. In this section, we examine whether these changes are accompanied by debt reallocation across subsidiaries. Firms that failed the gateway test in 2010 could reallocate debt held in the UK to other high tax countries not to lose the benefit of interest expensing. While we cannot differentiate between internal and external debt using Orbis, we expect the net-of-cash leverage ratio to increase among the non-UK subsidiaries of treated MNCs, if affected firms have reallocated their debt away from the UK. Further, we expect the

increase in the net-of-cash leverage ratio to be more substantial in host countries with higher corporate income tax rate.

Using information on leverage of non-UK subsidiaries of multinational firms that had at least one subsidiary located in the UK in 2010, we test our hypotheses by estimating Equation (4). Throughout all columns in Table 3, we control for common business cycle effects and subsidiary-specific fixed effects. In columns 1-5, we use the full sample of MNCs. In column 1, we estimate Equation (4) without adding any control variables. We find that multinationals which failed the gateway test in the UK have on average increased the leverage ratio in their non-UK subsidiaries by 0.252 after the reform relative to multinationals in the control group. Controlling for subsidiaries' size and profitability, and parent size (column 2) and host country year fixed effects (column 3), we continue to find a significant increase in the leverage ratio of non-UK subsidiaries of failed MNCs, relative to that of the control group. The magnitude of the effect is reduced to 0.114 increase in leverage ratio of non-UK subsidiaries. These results show that the UK worldwide debt cap led to reallocation of debt from UK to non-UK subsidiaries of affected MNCs.

To test our second hypothesis that failed MNCs have stronger incentives to reallocate debt to subsidiaries facing a higher corporate income tax rate, we multiply  $\text{Failed}_i \times \text{Post}_t$  by each host country's statutory corporate income tax rate.<sup>8</sup> Result based on this specification is reported in column 4. The point estimate for  $\text{Failed}_i \times \text{Post}_t \times \text{CIT}_{i,j,s,t}$  is positive and statistically significant at the 10 percent level. This suggests that leverage increased more in non-UK subsidiaries facing a higher corporate income tax rate. In column 5, we construct a dummy variable that is equal to 1, if the statutory tax rate in a host country was higher than the UK statutory tax rate in 2010 (28%). Consistent with column 3 results, we find a significant increase in leverage among subsidiaries that face a higher corporate income tax rate than 28%. The results in column (4) and (5) suggest that affected MNC more likely to reallocate their UK internal debt to countries with high tax rates. Hence, this debt reallocation is likely motivated by tax planning.

---

<sup>8</sup> We obtain each host country's statutory corporate income tax rate from the Oxford University Centre for Business Taxation.

In columns 6-8, we repeat the estimations based on the specifications in columns 3-5 using the sub-sample of subsidiaries that belong to a UK-headquartered MNC. In columns 9-11, we analyse debt reallocation using the sub-sample of subsidiaries that belong to a non-UK-headquartered MNC. We find that both types of multinational firms have increased leverage in their non-UK subsidiaries following the reform, relative to the control group.

These results point towards an interesting pattern in debt reallocation for the two types of multinational firms. The UK-headquartered firms that failed the gateway test in 2010 have reduced their net UK debt without making any changes to their worldwide gross debt holdings. At the same time, they also increase leverage of their non-UK subsidiaries. This suggests that they may reallocate internal debt to non-UK subsidiaries to offset the impact of the worldwide debt cap. To experience no change in the overall gross debt, the amount of debt that they shift away from the UK subsidiaries has to match the increase in leverage in their non-UK subsidiaries.

In contrast, we found that the non-UK-headquartered multinationals have experienced no change in their net UK debt, but instead adjusted their worldwide gross debt only. This means that this gross debt adjustment is likely to be reflected by an increase in external borrowing of their non-UK subsidiaries. It is entirely plausible that the non-UK headquartered multinational firms adjust the external borrowing of their UK subsidiaries to achieve the increase in the worldwide gross debt. We test this by looking at external leverage ratio for UK subsidiaries with non-UK parents. We find that there was no change in the external borrowing of UK subsidiaries for those multinational firms following the debt cap reform in 2010. This suggest the adjustment is mainly done through non-UK subsidiaries. This is because it is easier to adjust this margin outside of the UK. We need to bear in mind the caveat that our leverage measure captures both internal and external borrowing and hence, it is impossible to further investigate at which margin the adjustment occurs.

#### **4.4 Impact of the worldwide debt cap on organizational structure**

We find that MNC reallocate their debt in response to the UK's tax reform. Another way to offset the impact of the tax reform is to adjust the firm's organisational structure. The reform requires to calculate the UK net debt ratio using relevant UK subsidiaries, which are defined

as 75% and above control rights. Hence, an MNC can sell out shares of its UK subsidiary to avoid including the subsidiaries' debt in the gateway test calculation. A more extreme solution would be to shut down its business in UK and acquire new affiliates in other countries. These organizational structure changes could be a costly but an effective method in offsetting the impact of the tax reform without changing the overall tax bill. One advantage of our data is that we obtain the dynamic panel of parent groups and their subsidiaries over time. We therefore explore the possible impact of the tax reform on the organizational structure.

Specially, for each group-year, we calculate the percent of subsidiaries located in the UK relative to all controlled subsidiaries in the group. This ratio measures the relative importance of UK business in the group. Similarly, we also calculated the percent of subsidiaries located in countries with higher and lower statutory tax rate than the UK. In addition, we calculated the percent of UK relevant subsidiaries, i.e. subsidiaries with 75% and above controlled shares. We then estimate the effect of the reform on the percentage of subsidiaries held in each of the groups of countries. We use percentages rather than numbers of substitutes because we are interested in the relative shifts in the importance of various locations for multinational debt location.

Table 4 present the results.<sup>9</sup> In columns (1), (3) (5) and (7) we control for the year fixed effects, while in columns (2) (4) (6) and (8) we further control for the parent fixed effects. We find that that treated groups, compared to groups which are not affected by the gateway test, have relatively more UK subsidiaries (column 5) and fewer subsidiaries in other counties (columns 1 and 3). We find support for the hypothesis that multinationals not only reallocate their debt holdings but are also likely to change the firm structure following the 2010 reform. Consistent with tax-motivated hypothesis, treated groups increased the fraction of their subsidiaries located in higher tax regimes by 0.47 (column 1 and 2), and reduced the fraction of subsidiaries located in lower tax regimes by 0.37 (column 3 and 4). These changes are statistically significant in 1 percent level. The increase in the fraction of subsidiaries held in higher tax regimes is not perfectly offset by the reduction in the fraction of subsidiaries held in lower tax regimes. Failed multinationals also reduce the fraction of relevant (over 75% held) subsidiaries in the UK by 0.014, without changing the overall fraction of subsidiaries held in the UK. These

---

<sup>9</sup> Note that we use all 1,268 multinational groups with at least one relevant subsidiary in the UK in 2010 and trace them across the 10 years sample period here, 2005 – 2014. Using the much smaller (220 groups) matched sample yields negative but insignificant point estimates.

last two changes are not significant though. This also suggests that multinationals are likely selling shares of the 75% and more owned subsidiaries so that they are not relevant for the calculation of the gateway tests. We show some evidence confirming this in section 4.5.

Our results show that the affected MNCs increase the proportion of subsidiaries in higher tax regimes following the reform. This is in line with debt shifting, which is one of the methods that multinationals use to reduce their overall tax bill. MNCs tend to arrange internal debt in the way that subsidiaries in low tax regimes provide loans to subsidiaries in high tax regimes. This increases leverage in high tax regimes. High tax subsidiaries reduce their profits by paying interest on those loans, which are tax deductible, and low tax subsidiaries receive interest income on which they pay little to no tax. Since the UK worldwide debt cap tax reform reduced the room for MNC to use UK as the internal debt host, we show that firms affected by this reform were likely to use subsidiaries in other countries, especially high tax rate countries, as a debt hub. These results imply that the debt cap reform may not have changed the overall leverage of affected multinational firms, neither their use of debt shifting as a profit strategy. Instead, the UK lost its function of a debt hub at the expense of other high tax countries. This has likely not changed the multinational's overall tax bill.

#### **4.5 Other robustness checks**

Our baseline test on the UK debt is based on the data from FAME, while our test for non-UK subsidiaries is based on data from Orbis. FAME provides detailed internal and external debt for UK firms, which allows us to construct the gateway ratio test following exactly the method that the HMRC has applied to multinational firms. However, FAME only contains UK subsidiaries. That is why we have to rely on Orbis data to study the debt reallocation hypothesis. In order to ensure that our test on non-UK firms using Orbis and the study on UK firms using FAME are comparable, we redo the baseline analysis on the UK firms using ORBIS data and net of cash leverage ratio measure. As before, we cannot observe whether the debt is internal or external in Orbis. Therefore, the measure of leverage using Orbis is noisy.

We report these test in Table 5. Columns 1 and 2 use the whole sample of UK multinationals, columns 3 and 4 consider UK headquartered multinationals only, while columns 5 and 6 look at non-UK headquartered multinational firms. Even with this noisy measure, we are able to confirm our conclusion from Tables 1 and 2. Treated groups significantly reduce the leverage

of their UK subsidiaries by 0.083 (column 1) in response to the tax reform. This effect is larger for the relevant subsidiaries of 75% and above control rights (column 2). A before, this effect is only significant for the UK-headquartered MNCs (columns 3 and 4), but not for MNCs headquartered in foreign countries (columns 5 and 6). UK-headquartered MNCs reduce both their relevant net UK debt and their UK leverage ratio following the reform. In contrast non-UK-headquartered MNCs adjust neither their net UK debt nor UK leverage ratio.

We repeat our test on debt allocation, as reported in Table 3, by aggregating subsidiaries leverage to a multinational group - country level. We add up net of cash leverage and total assets of all subsidiaries belonging to the same multinational parent in a given host country and divide one over the other to obtain multinational group - country leverage ratios. We do not report those result here as the coefficients are not statistically significantly different from the ones obtained in Table 3.

Finally, we find weak evidence that MNCs shift debt from relevant subsidiaries with 75% or above control to UK subsidiaries with 50%-75% controls. We already showed that UK subsidiaries of UK-headquartered multinational firms reduce their leverage ratio in response to the 2010 reform relative to the control group. This decrease is larger for 75% or more owned subsidiaries. This suggests looking at leverage of companies that were owned 50-75% by UK-headquartered multinationals. We find that these subsidiaries have increased their leverage ratio after the reform by 0.73. The coefficient from this regression is reported with large (0.77) standard error though.

## **Conclusions**

This paper analyzes the response of multinational companies' debt allocation to the UK worldwide debt cap reform in 2010. The reform restricted tax deductions available to the UK subsidiaries of multinational companies. We collect subsidiary and group-level financial information from three different databases. We conduct a difference-in-differences analysis based on matched sample, which makes the treated and control groups more comparable. We provide causal evidence on the negative effect of the imposition of debt cap on the ratio of UK net debt to the multinational worldwide debt holdings. We show that multinational companies headquartered in the UK reduce their net UK debt in response to the debt cap, while

multinationals headquartered in foreign countries increase their worldwide debt to achieve the required debt ratio.

We then show that multinational firms reallocate debt from their UK subsidiaries to non-UK subsidiaries, especially those in high tax countries. These patterns are consistent with debt shifting strategies, as multinationals affected by the reform strive to keep their overall tax bill unchanged. We also find that the affected multinationals substitute their low tax subsidiaries with high tax subsidiaries to be able to use the high tax jurisdictions as debt hubs, instead of the UK. These two put together suggest that the worldwide debt cap approach only leads to debt reallocation and does not effectively curb multinationals' use of debt for tax planning purposes. This is consistent with the replacement of the worldwide debt cap with the new rule to limit the use of debt for tax-planning purposes in April 2017.

## References

Blouin, J., Huizinga, H., Laveven, L., and Nicodeme, G. (2014). “Thin Capitalization Rules and Multinational Firm Capital Structure,” IMF working paper 14/12.

Buettner, T., Overesch, M., Schreiber, U., and Wamser G. (2012). “The impact of thin-capitalization rules on the capital structure of multinational firms”, *Journal of Public Economics*, Vol. 96: 930-938.

Davies, R. B., Martin, J., Parenti, M., & Toubal, F. (2018). Knocking on Tax Haven's Door: Multinational Firms and Transfer Pricing. *The Review of Economics and Statistics*, forthcoming . doi:10.1162/REST\_a\_00673

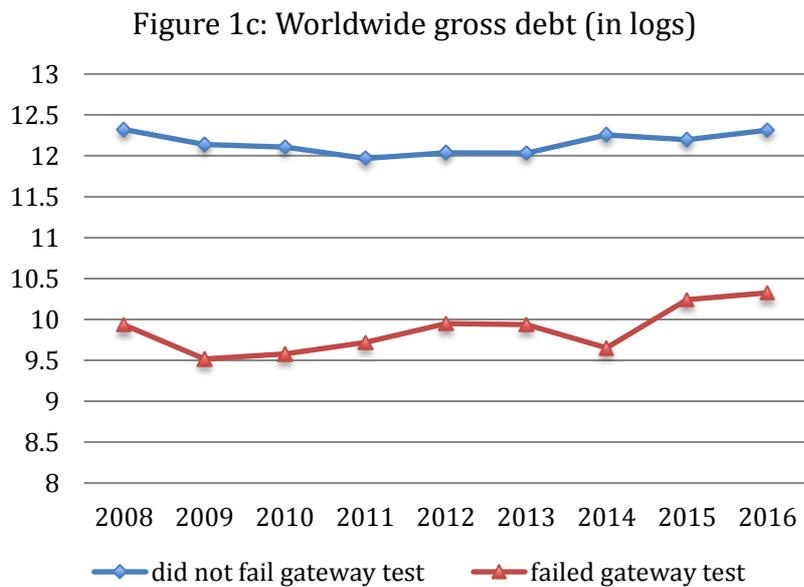
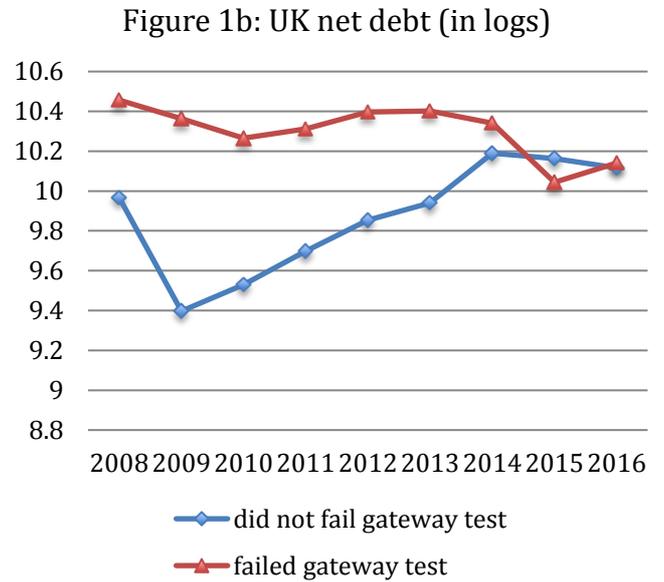
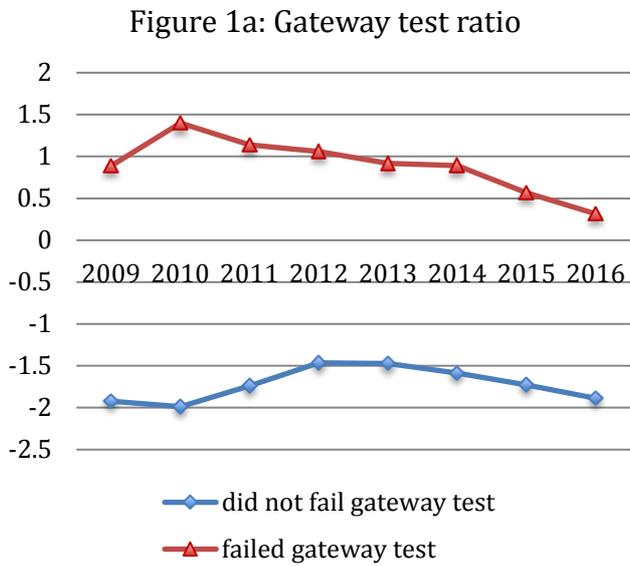
Desai, M. A., Foley, C. F., & Hines, &. (2004). A multinational perspective on capital structure choice and internal capital markets. *The Journal of Finance*, 59(6), 2451-2487.

Dharmapala, D. (2014). What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. *Fiscal Studies*, 35(4), 421–448.

Hanlon, M., & Heitzman. (2010). A review of tax research. *Journal of Accounting and Economics*, 50(2), 127-178.

Huizinga, H., & Laeven, L. (2008). International profit shifting within multinationals: A multi-country perspective. *Journal of Public Economics*, 92(5), 1164–11

**Figure 1. Time-series evolution of the average gateway test ratio net UK debt and worldwide gross debt of the treated and the control groups.**



**Figure 2. Time-series evolution of the average gateway test ratio net UK debt and worldwide gross debt of the treated and the control groups – UK headquartered and non-UK headquartered MNCs.**

Figure 2a UK headquartered MNCs

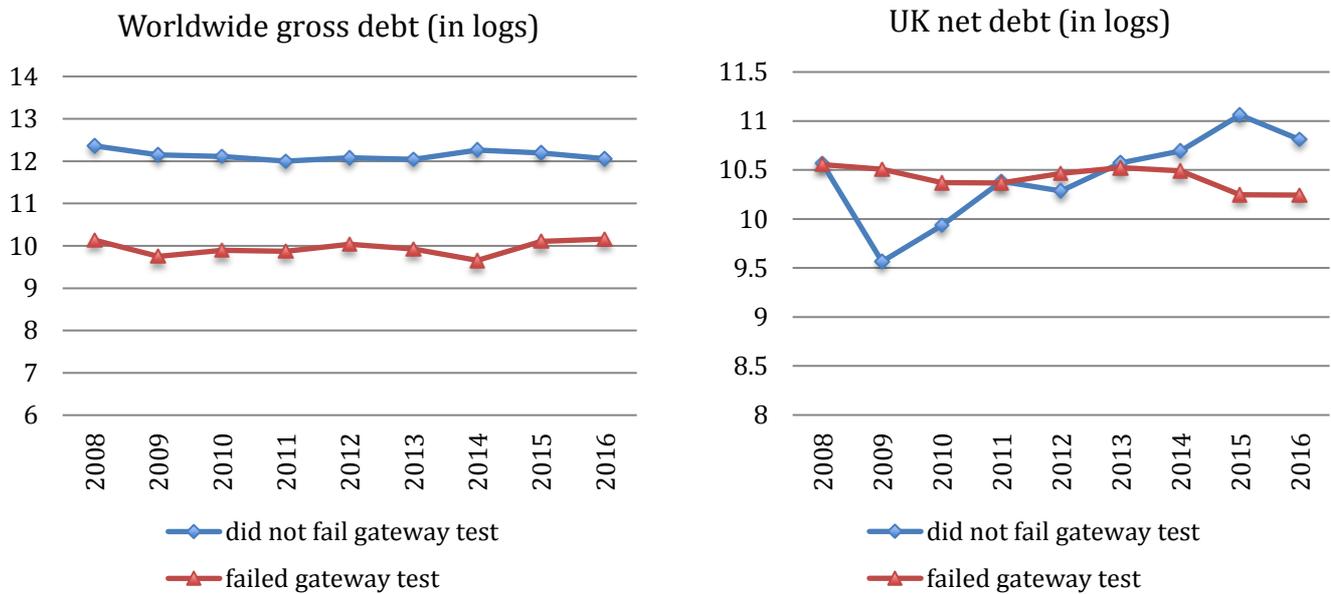
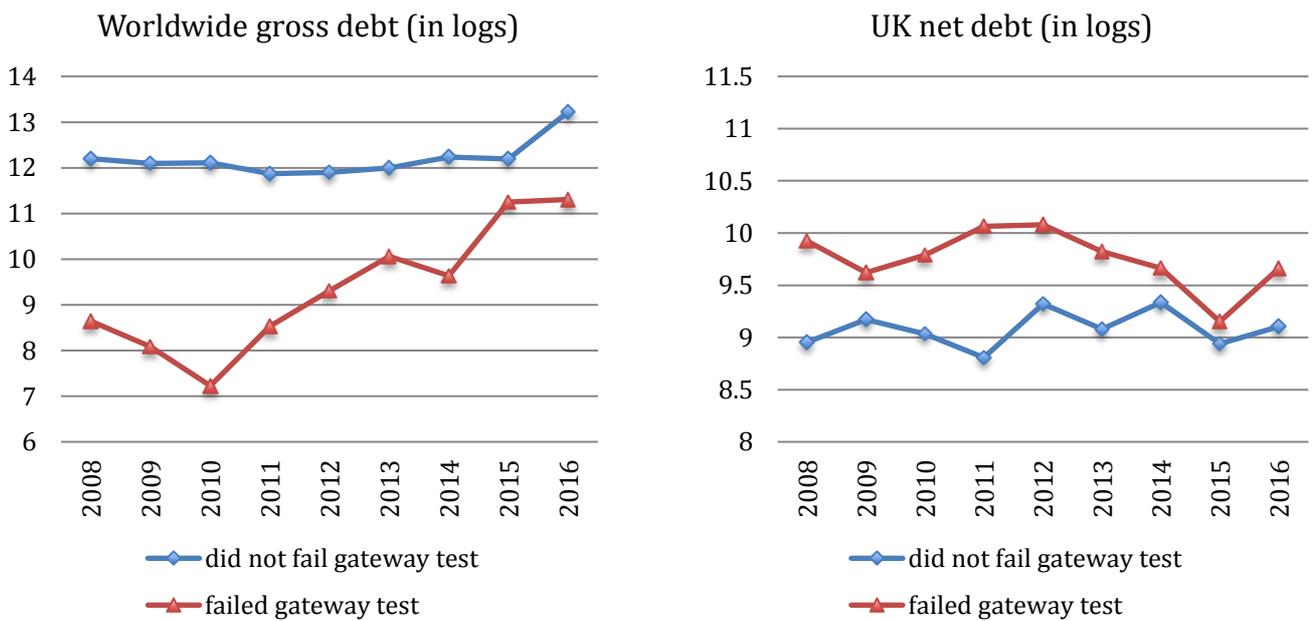


Figure 2b: non-UK headquartered MNCs.



**Table 1: Impact of the worldwide debt cap on group-level debt holdings**

VARIABLES	Gateway ratio		UK net debt		Gross debt	
	(1)	(2)	(3)	(4)	(5)	(6)
Failed <sub><i>i</i></sub>	2.414*** (0.222)		0.738*** (0.283)		-0.800*** (0.191)	
Failed <sub><i>i</i></sub> × Post <sub><i>t</i></sub>	-0.517*** (0.180)	-0.338** (0.167)	-0.286* (0.169)	-0.328** (0.159)	0.223 (0.160)	0.107 (0.145)
Group size	-0.363*** (0.085)	-1.051*** (0.242)	0.372*** (0.099)	0.287** (0.116)	1.098*** (0.059)	1.497*** (0.162)
Group UK profitability	-0.221 (0.210)	0.041 (0.251)	-0.260** (0.128)	-0.351*** (0.095)	-0.015 (0.198)	-0.281 (0.230)
Industry FE	YES	NO	YES	NO	YES	NO
Year FE	YES	YES	YES	YES	YES	YES
Group FE	NO	YES	NO	YES	NO	YES
No. of groups	220	220	150	150	220	220
Observations	1,428	1,428	897	897	1,820	1,820

Note: Baseline results using the 75% ownership criteria, excluding financial services companies and excluding UO, UO- and JO ownership categories. Propensity score matching on industry, GUO location, GUO size and profitability in 2010, matching one-to-one without replacement. Gross deb is worldwide gross debt of a whole multinational group, UK debt is net UK debt holdings for all UK subsidiaries, gateway is the ratio of net UK debt to worldwide gross debt

**Table 2: Impact of the worldwide debt cap on group-level debt holdings--headquarter heterogeneities**

VARIABLES	Gateway ratio		UK net debt		Gross debt	
	(1) UK	(2) Non-UK	(3) UK	(4) Non-UK	(5) UK	(6) Non-UK
Failed <sub>i</sub> × Post <sub>t</sub>	-0.203 (0.168)	-1.187** (0.514)	-0.506** (0.213)	-0.075 (0.266)	-0.142 (0.134)	1.690*** (0.480)
Parent size	-0.765*** (0.212)	-2.111*** (0.599)	0.335** (0.141)	0.260 (0.180)	1.206*** (0.150)	2.088*** (0.365)
Parent profitability	0.216 (0.157)	-0.349 (0.552)	-0.445*** (0.157)	-0.261** (0.107)	-0.499*** (0.180)	0.172 (0.459)
Year FE	YES	YES	YES	YES	YES	YES
Group FE	YES	YES	YES	YES	YES	YES
Number of groups	177	43	116	34	177	43
Observations	1,199	229	666	231	1,485	335

Note: UK vs foreign owned multinationals with parent as a unit of observation; using the 75% ownership criteria; excluding financial services companies and excluding UO, UO- and JO ownership categories. Propensity score matching on industry, GUO location, GUO size and profitability in 2010, matching one to one without replacement. Gross debt is worldwide gross debt of a whole multinational group, UK debt is net UK debt holdings for all UK subsidiaries, gateway is the ratio of net UK debt to worldwide gross debt.

**Table 3: Impact of the worldwide debt cap on non-UK subsidiaries' leverage ratio**

VARIABLES	All MNCs					UK-headquartered MNCs			Non-UK-headquartered MNCs		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Failed <sub>i</sub> × Post <sub>t</sub>	0.252** (0.098)	0.144** (0.070)	0.114* (0.066)		0.051 (0.036)	0.125* (0.072)		0.029 (0.040)	0.021 (0.110)		0.186* (0.100)
Failed <sub>i</sub> × Post <sub>t</sub> × CIT <sub>i,j,s,t</sub>				0.769** (0.388)			0.729* (0.421)			0.760* (0.432)	
Failed <sub>i</sub> × Post <sub>t</sub> × HighTax <sub>i,j,s</sub>					0.230* (0.135)			0.239* (0.140)			-0.025 (0.095)
Subsidiary profitability		-0.127* (0.070)	-0.004 (0.046)	-0.125* (0.069)	-0.121* (0.069)	-0.016 (0.065)	-0.117* (0.071)	-0.110 (0.069)	0.024 (0.105)	-0.082 (0.195)	-0.083 (0.196)
size		0.019 (0.050)	0.015 (0.048)	0.015 (0.051)	0.007 (0.053)	-0.034 (0.048)	0.004 (0.038)	-0.008 (0.041)	0.226*** (0.075)	0.030 (0.149)	0.023 (0.151)
Parent size		-0.004 (0.076)	-0.007 (0.091)	-0.010 (0.076)	-0.020 (0.075)	0.027 (0.105)	0.030 (0.084)	0.015 (0.081)	-0.041 (0.137)	-0.171 (0.217)	-0.167 (0.217)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Host country-year FE			YES			YES			YES		
Subsidiary FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,602	1,314	1,314	1,310	1,314	927	924	927	387	386	387
matching	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Note: All multination and UK vs foreign owned multinationals with parent as a unit of observation; using the 75% ownership criteria; excluding financial services companies and excluding UO, UO- and JO ownership categories. Propensity score matching on industry, GUO location, GUO size and profitability in 2010, matching one to one without replacement. Gross debt is worldwide gross debt of a whole multinational group, UK debt is net UK debt holdings for all UK subsidiaries, gateway is the ratio of net UK debt to worldwide gross debt

**Table 4: Impact of the worldwide debt cap on organizational structure**

VARIABLES	Higher tax countries		Lower tax countries		UK		UK 75+	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Failed <sub>i</sub>	-0.229***		-0.143***		0.374***		0.366***	
	(0.017)		(0.016)		(0.025)		(0.024)	
Failed <sub>i</sub> × Post <sub>t</sub>	0.043***	0.047***	-0.028**	-0.037***	-0.005	-0.001	-0.022	-0.014
	(0.013)	(0.013)	(0.012)	(0.013)	(0.017)	(0.017)	(0.018)	(0.019)
Constant	0.412***	0.398***	0.187***	0.168***	0.395***	0.424***	0.372***	0.401***
	(0.011)	(0.008)	(0.008)	(0.006)	(0.012)	(0.007)	(0.012)	(0.007)
Observations	12,181	12,181	12,181	12,181	12,181	12,181	12,181	12,181
R-squared	0.061	0.739	0.095	0.766	0.151	0.843	0.153	0.822
Industry FE	NO	NO	NO	NO	NO	NO	NO	NO
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Group FE	NO	YES	NO	YES	NO	YES	NO	YES
controls	NO	NO	NO	NO	NO	NO	NO	NO
matching	NO	NO	NO	NO	NO	NO	NO	NO

Note: Dependent variable in columns 1 and 2 is proportion of subsidiaries countries in countries with statutory tax rate higher than UK relative to total subsidiaries in the group. Dependent variable in columns 3 and 4 is proportion of subsidiaries countries in countries with statutory tax rate lower than UK. In columns (5) and (6), dependent variable is the proportion of UK subsidiaries with control share above 50%. In columns (5) and (6), dependent variable is the proportion of UK subsidiaries with control share above 75%

**Table 5 Cross check of the impact of worldwide debt cap on UK debt using Orbis data**

VARIABLES	(1) lev3	(2) lev3 75+	(3) lev3 UK	(4) lev3 UK 75+	(5) lev3 foreign	(6) lev3 foreign 75+
Failed <sub><i>i</i></sub> × Post <sub><i>t</i></sub>	-0.083** (0.035)	-0.096*** (0.037)	-0.115** (0.045)	-0.134*** (0.046)	-0.018 (0.041)	0.028 (0.072)
Parent profitability	0.001*** (0.000)	-0.007 (0.030)	-0.116** (0.047)	-0.096*** (0.037)	0.001*** (0.000)	0.048 (0.048)
Parent size	-0.000 (0.026)	0.005 (0.017)	-0.036 (0.070)	-0.038 (0.046)	0.023 (0.060)	0.062 (0.065)
Constant	-2.372* (1.362)	-1.354 (1.536)	-2.792 (2.038)	-2.104 (2.283)	-1.839 (1.628)	-0.347 (1.104)
Observations	5,923	4,774	3,105	2,794	2,818	1,980
R-squared	0.028	0.014	0.050	0.040	0.016	0.011
Year FE	YES	YES	YES	YES	YES	YES
Sub FE	YES	YES	YES	YES	YES	YES
controls	YES	YES	YES	YES	YES	YES
matching	NO	NO	NO	NO	NO	NO

Note: Dependent variable in net-of-cash leverage ratio. Column 1 use all subsidiaries located in UK. Column 2 uses the subsidiaries controlled by parent group with more than 75% shares. Columns 3 and 4 examines subsidiaries affiliated to parent group, which is headquartered in UK. Columns 5 and 6 examines subsidiaries affiliated to parent group, which is headquartered outside of UK.

columns 1 and 2 is proportion of subsidiaries countries in countries with statutory tax rate higher than UK relative to total subsidiaries in the group. Dependent variable in columns 3 and 4 is proportion of subsidiaries countries in countries with statutory tax rate lower than UK. In columns (5) and (6), dependent variable is the proportion of UK subsidiaries with control share above 50%. In columns (5) and (6), dependent variable is the proportion of UK subsidiaries with control share above 75%